

ABNORMALLY MILD TEMPERATURES IN THE CANADIAN ARCTIC DURING JANUARY 1958*

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1. INTRODUCTION

The winter of 1957-1958 has produced abnormal weather conditions in many parts of the world. There have been periods of unusually stormy and cold weather in the southeastern United States, and severe blizzards in the Great Lakes area of Canada and the United States as well as in the United Kingdom. On the other hand, record maximum temperatures for January have been established both in western and northeastern Canada. The most significant of these record high temperatures occurred in the northern Arctic islands.

Based on data contained in the regular coded surface synoptic weather reports and unchecked January monthly summaries, the highest temperature reported in the Arctic this January was 40° F. above zero at Arctic Bay on January 22 and 23. This temperature and the values of 32° F. at Alert and 30° F. at Eureka, both on January 24, are the only occurrences of near or above freezing temperatures ever reported in January from the Canadian Arctic north of latitude 70° N. In fact, these January 1958 maximum temperatures are higher than any temperature ever recorded previously during the 6 months from November to April inclusive.

2. MAXIMUM TEMPERATURES

Isotherms of extreme highest recorded temperatures for January are shown for the Canadian Arctic in figure 1. The solid isotherms represent the extreme maximum temperatures up to and including January 1958 while the dashed lines indicate the isotherms as they were previous to January 1958. It can be readily seen from this map that exceptionally mild weather was experienced in Baffin and Ellesmere Islands.

The period of record at each station is shown in table 1 which gives in tabular form the values mapped in figure 1. At Arctic Bay from 1938 to 1957 the highest January temperature recorded was 28° F. in 1945, while in this most recent January, 40° F. is shown as the maximum temperature on both January 22 and 23. Over a slightly shorter period of record at Frobisher from 1942 to 1957, the highest January temperature was 30°, while on January 21 this year a value of 39° was recorded. In southern Baffin Island the record high temperature of 48° recorded at Pangnirtung in 1931 was probably not

TABLE 1.—*Extreme highest recorded temperatures (F.°) in Northeastern Arctic Canada*

| Code | Name | Previous Januarys | | | January 1958 | |
|------|------------------------|------------------------|---------|------|--------------|--------|
| | | Period | Maximum | Year | Maximum | Date |
| LT | Alert..... | 1950-57 | 17 | 1957 | 32 | 24 |
| EU | Eureka..... | 1947-57 | 24 | 1952 | 30 | 24 |
| IC | Isachsen..... | 1948-57 | 20 | 1952 | 25 | 23 |
| MD | Mould Bay..... | 1948-57 | 15 | 1957 | 6 | 22 |
| RB | Resolute..... | 1947-57 | 22 | 1952 | 23 | 23 |
| CR | Craig Harbour..... | 1934-40 | 20 | 1940 | ----- | ----- |
| DH | Dundas Harbour..... | {1931-33} {1946-48} | 26 | 1947 | ----- | ----- |
| AB | Arctic Bay..... | 1938-57 | 28 | 1945 | 40 | 22, 23 |
| PI | Pond Inlet..... | {1922-27} {1931-51} | 20 | 1945 | ----- | ----- |
| CY | Clyde..... | 1943-57 | 31 | 1955 | 29 | 24 |
| RO | Fort Ross..... | 1938-48 | 19 | 1940 | ----- | ----- |
| NC | Spence Bay..... | 1951-57 B | 8 | 1952 | 29 | 22 |
| UX | Hall Lake..... | 1956-57 | 12 | 1956 | 34 | 21 |
| PO | Padloping Island..... | 1941-56 | 31 | 1945 | ----- | ----- |
| PU | Pangnirtung..... | 1931-40 | 48 | 1931 | ----- | ----- |
| FB | Frobisher..... | 1942-57 | 30 | 1955 | 39 | 21 |
| RE | Resolution Island..... | 1929-57 | 34 | 1940 | 35 | 21 |

B=Broken period.

TABLE 2.—*Winter season monthly values of extreme highest recorded temperature (F.°) at representative stations*

| Code | Name | Period | Period of record to 1957 | | | | | | | | January 1958 |
|------|------------------------|---------|--------------------------|------|------|------|------|------|------|-----|--------------|
| | | | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | |
| LT | Alert..... | 1950-57 | 33 | 31 | 13 | 17 | 25 | 28 | 30 | 47 | 32 |
| EU | Eureka..... | 1947-57 | 39 | 29 | 11 | 24 | 6 | 8 | 26 | 42 | 30 |
| IC | Isachsen..... | 1948-57 | 28 | 25 | 11 | 20 | -8 | 17 | 35 | 36 | 25 |
| RB | Resolute..... | 1947-57 | 32 | 27 | 17 | 22 | 6 | 20 | 30 | 40 | 23 |
| AB | Arctic Bay..... | 1937-57 | 44 | 36 | 34 | 28 | 36 | 34 | 36 | 51 | 40 |
| FB | Frobisher..... | 1942-57 | 45 | 42 | 33 | 30 | 27 | 39 | 41 | 56 | 39 |
| RE | Resolution Island..... | 1929-57 | 45 | 39 | 35 | 34 | 34 | 37 | 39 | 45 | 35 |
| KL | Knob Lake..... | 1949-57 | 62 | 46 | 41 | 31 | 39 | 49 | 47 | 83 | 40 |
| YR | Goose Bay..... | 1942-57 | 73 | 60 | 53 | 42 | 51 | 54 | 62 | 89 | 46 |

exceeded this year (1958) although the lack of an observing station at this location at present leaves the matter in doubt.

Mean temperatures during January 1958 for northern Baffin Island and Ellesmere Island were in the neighborhood of -15° to -20° F. Farther west, stations on the smaller islands had mean temperatures lower than -20°. This January was the warmest January on record at five Arctic weather stations—Alert, Eureka, Resolute, Isachsen, and Mould Bay. The departure from normal in northern Ellesmere Island was 16 F.° which is the greatest positive temperature anomaly ever observed in January in far northern Canada. There have been, however, several warmer Januarys on Baffin Island. At Arctic

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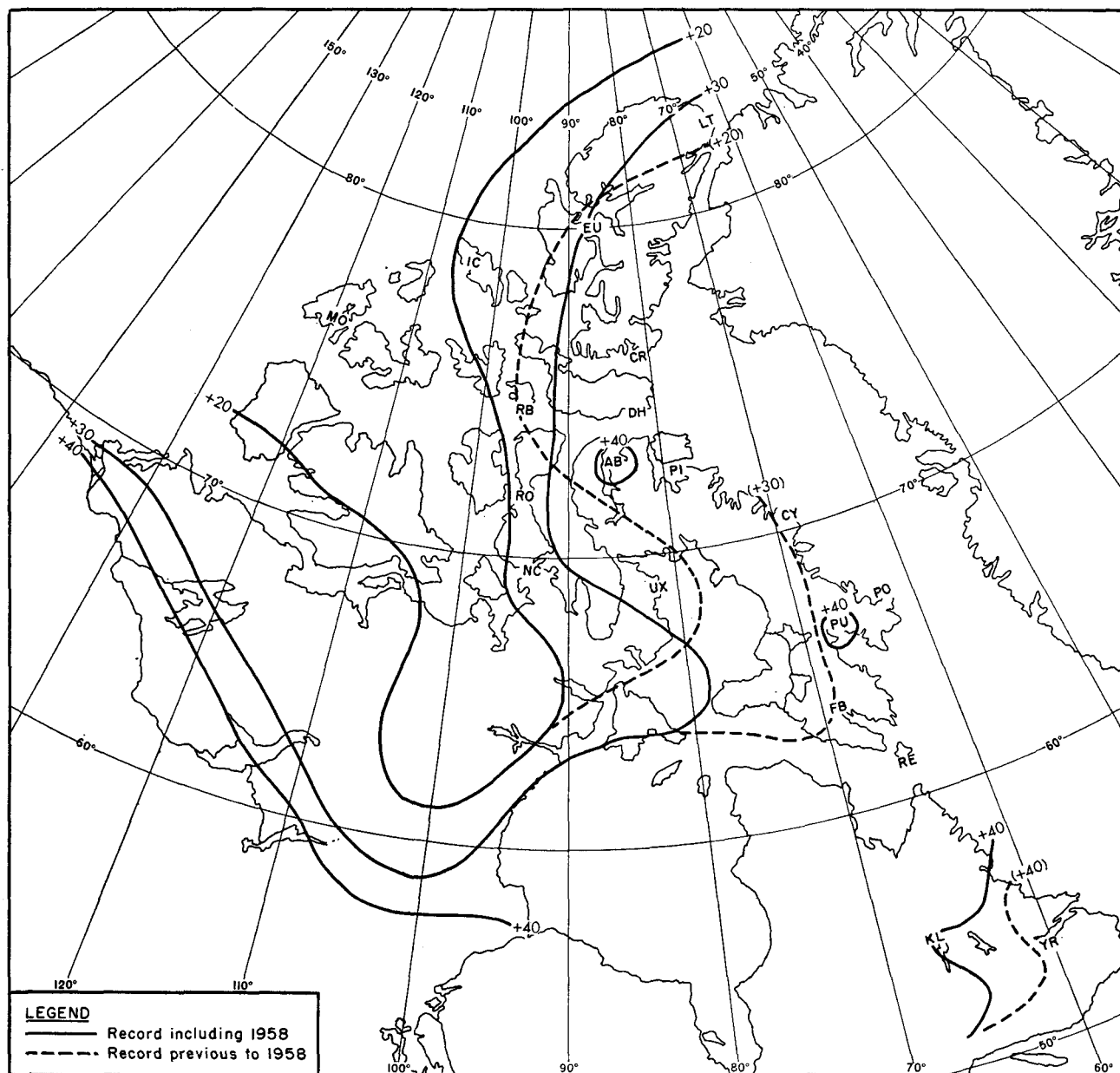


FIGURE 1.—Extreme highest recorded temperatures in January.

Bay the mean temperature was -17° compared to a normal value of -22° while the warmest January on record, 1940, had a mean temperature of -1° . Along the coast at Clyde, mean temperatures over the month of January 1958 were normal.

With the exception of a 3-year period from 1928–1930, temperature records are available since 1921 from one or more stations in the Canadian Arctic north of latitude 70° N. During this time, above freezing temperatures in January have never been reported previous to 1958. The years with extremely warm periods in January have been 1940, 1945, and 1952, when maximum temperatures in excess of 20° were reported from stations such as Arctic Bay, Resolute, and Eureka. Temperatures in excess of 20° have been reported slightly more frequently at such coastal stations as Clyde, Pond Inlet, and Craig Harbour.

An interesting situation was observed during the month

at Clyde where the temperature remained low after the warm front had passed. On January 23 when the other Baffin Island stations had temperatures near or in excess of 32° F. the Clyde temperature remained below zero. This was probably because of the topography at Clyde which acted to trap the cold air at the surface while the warmer Maritime Arctic air passed over the top of the fjord in which the station is located. The cold air eventually moved out and on January 24 Clyde reported a maximum temperature of 29° .

There were at least 7 or 8 stations in Ungava and Labrador where January high temperature records were broken. The most significant instances were temperatures of 46° at Goose Bay and 39° at Frobisher where the previous maxima had been 42° and 34° respectively. Also, at Resolution Island, where a relatively long record dates back to 1929, a new January high of 35° was estab-

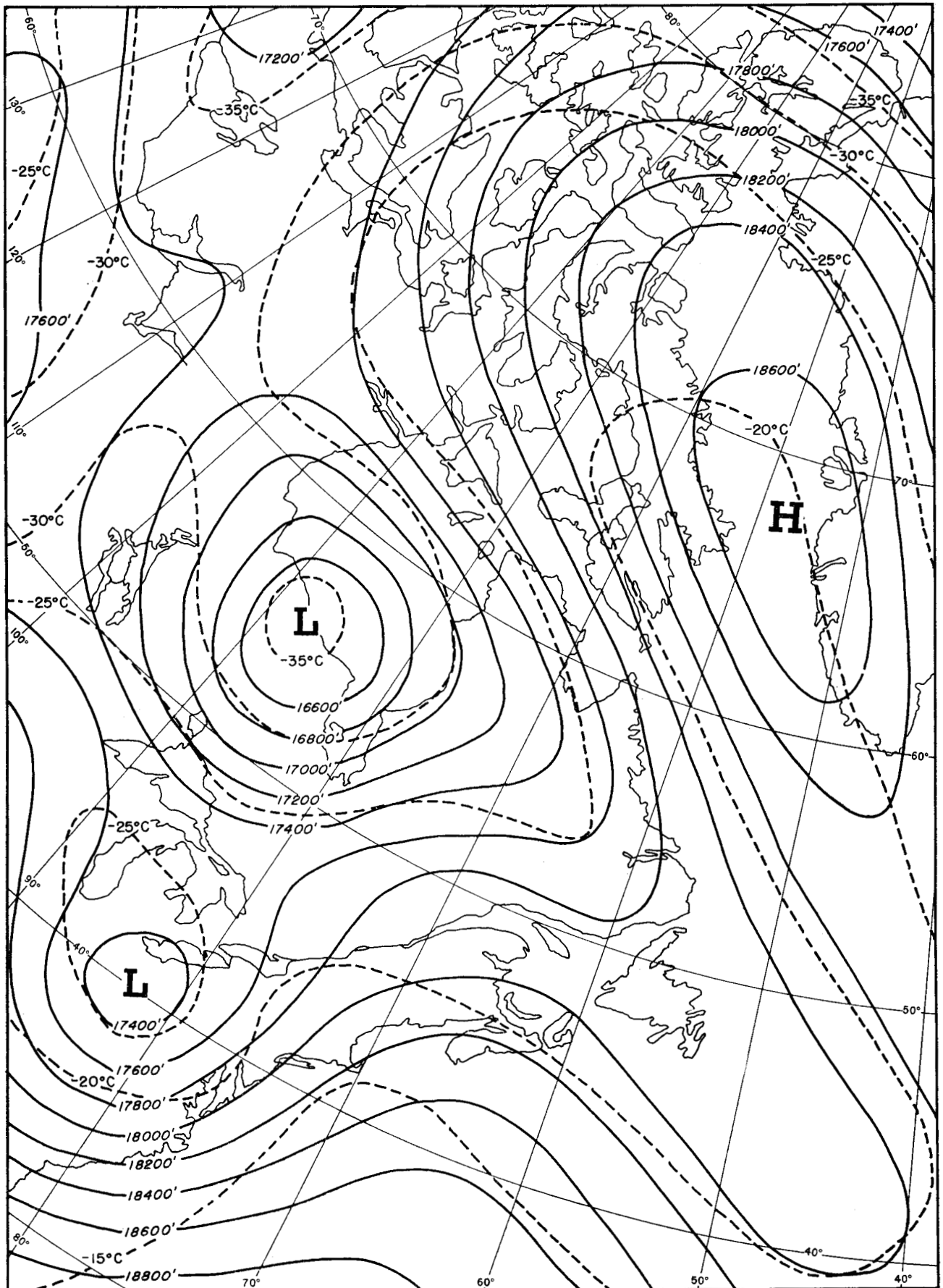


FIGURE 2.—500-mb. contours and isotherms, 1200 GMT, January 22, 1958.

lished replacing an old record of 34°. January records were also broken at two isolated locations in western Canada. At Prince Rupert, B. C., where the record dates back to 1913, the previous January high temperature was 62° but on January 6, 1958 a new high of 64° was recorded. At Dawson in Yukon Territory, where observations have been taken since 1898, the old high temperature of 36° was broken when 47° was reported on January 7, 1958.

It should be emphasized that some of the temperature values listed here have been taken from coded synoptic reports and unchecked abbreviated monthly messages. When all the original basic data sheets have been forwarded to the Headquarters of the Meteorological Branch, and the data thoroughly processed, it is possible that some of the values listed here will be changed.

3. SYNOPTIC CHARACTERISTICS

During the first few days of January an east-west orientated high pressure area lay across the northern Arctic islands. During this period Resolute experienced one of the coldest, windiest storms on record. From January 7 to 12, a series of Pacific low pressure areas moved from west to east across the continent, as a few Atlantic coastal Lows moved up the coast to the vicinity of Davis Strait. During this time, there were no major outbreaks of Arctic air over the continent. The situation began to change January 13–15 as Highs began to build up over the continent. From January 16–19, there was a strong High over the northeastern Arctic and Greenland while a Low moved northwestward across Quebec to Hudson Bay. As a result, maritime Arctic air moved northward over the Atlantic Ocean and by January 20 had reached the latitude of Hudson Strait. At the same time an intense Low southeast of Newfoundland was drifting slowly eastward and this served to maintain an unbroken southeasterly flow of relatively warm air from latitude 40° N. northward to Baffin Island. On January 21, maritime tropical air appeared at the surface as far north as latitude 48° N. By January 22, while continental Arctic air covered all southeastern Canada, maritime Arctic air was over Baffin Island as far north as Arctic Bay. The southeasterly to southerly flow between the High over Greenland and the Low persisting in the vicinity of Hudson Bay continued to sweep the maritime Arctic air northward, and this air reached the mid-part of Ellesmere Island on January 23. On this date most stations on Baffin Island reported temperatures of 32° F. or higher. On January 24 continental Arctic air swept eastward over Baffin Island, and by the 25th had reached Ellesmere Island, bringing to an end this regime of abnormally mild weather in the Canadian Arctic. Just before the invasion of this colder air, Alert, near the north shore of Ellesmere Island, reported a 38° F. reading at 2,000 ft. above the surface.

As might be expected, the abnormally warm temperatures at the surface level in northeastern Canada during

this period were also accompanied by a thrust of warm air aloft over this region. Following the cold air thrust southward over the eastern United States about the middle of the month, a quasi-stationary Low developed just west of Cape Cod at all levels in the troposphere and warm air flowed northward at upper levels over the Atlantic Provinces and northeastern Quebec from January 16 to 19. By the 19th a well-developed upper Low had formed over Hudson Bay, and persisted in that general vicinity at all levels in the troposphere for the next 5 days. The resulting southeasterly flow east of this Low and to the east of the migratory Lows which moved off the Atlantic coast at 40° to 45° N. continued to force warm air over northeastern Canada and then northward over the eastern Canadian Arctic Islands. The –25° C. isotherm at the 500-mb. level located at 50° to 55° N. across Quebec on January 17 advanced to latitude 70° N. over Baffin Island by January 19, and reached latitude 82° N. over Ellesmere Island on January 24. Figure 2, showing the 500-mb. flow at 1200 GMT January 22, is typical of the general flow that persisted aloft from January 19 to 24. During this period, upper-air temperatures at 700 and 500 mb. were at times 20 to 25 C.° above normal for January over Baffin Island, and 15 to 20 C.° above normal over Ellesmere Island [3].

4. CONCLUSION

A study of the normal temperature pattern during January in the Canadian Arctic indicates that the eastern coast adjoining Davis Strait and Baffin Bay often has much warmer temperatures than can be expected in the western Arctic [1, 2, 4]. Besides the moderating effect of the water and ice, this coastal area is also subjected to maritime Arctic and maritime polar air thrusts from the south as low pressure systems move northward to the west of Greenland. The amount and extent of the warm air moving into the Arctic varies directly as the intensity and location of the cyclonic activity. On occasions when the surface low pressure system moves in a west-northwesterly direction across the top of Hudson Bay, the warm sector of the depression is extensive enough to move the warm air north not only over Baffin Bay but also over and to the west of Baffin Island. That is what occurred on January 19–24, 1958 and as a result the northeastern Arctic experienced some abnormally high winter-time temperatures.

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